U.S. Army Corps of Engineers

Pittsburgh District

YOUGHIOGHENY LAKE WATER MANAGEMENT AND REALLOCATION STUDY

DRAFT
ECONOMICS APPENDIX
to the
FEASIBILITY REPORT

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1 INTRODUCTION

This appendix documents the economic analysis and calculations conducted in support of the Youghiogheny Lake Water Management and Reallocation Feasibility Study. ER 1105-2-100 (22 April 00) Section VII Water Supply describes the economic evaluations required for an analysis of the feasibility of reallocation of storage at a Corps project.

The 1997 Youghiogheny Lake Water Management and Reallocation Reconnaissance Study, conducted by the Pittsburgh District of the U.S. Army Corps of Engineers, recommended reexamination of the storage and release schedule of Youghiogheny Lake to determine the potential for reallocating a portion of lake storage for water supply. The Municipal Authority of Westmoreland County (MAWC) is seeking a reallocation of storage that would provide 17 MGD, during those days when additional augmentation is required, to be withdrawn from the Youghiogheny River at Connellsville. This storage reallocation would require that water supply be added as a project purpose to the Youghiogheny River Lake project.

This document is organized into three remaining sections. Section 2 presents the estimated current and future water supply need based on data provided by MAWC, the feasibility study non-Federal partner. Section 3 calculates the costs of reallocation and includes an assessment of financial feasibility, and Section 4r evaluates the economic impacts of alternative plans.

2 WATER SUPPLY NEEDS ASSESSMENT

The purpose of the water supply needs analysis is to identify any deficit in existing and projected MAWC water supply that may be met by reallocating existing storage in the Youghiogheny Lake.

The water supply needs analysis is based on future water supply and demand projections provided by MAWC in their 1999 Long Range Plan. The stated purpose of the Long Range Plan is to accurately depict MAWC's current ability to meet the needs of the community it serves and to identify a plan of action to meet projected future needs. This plan contains an assessment of the system's existing and future supply capabilities and a projection of future demand based on Pennsylvania Department of Environmental Protection (PADEP) population projections for each municipality served.

2.1 Study Area

MAWC currently provides potable water to more than 111,000 customers through a 2,000 mile distribution system that spreads over 672 square miles in south western Pennsylvania. MAWC's service area includes 71 municipalities in five counties: Armstrong, Fayette, Indiana, Somerset, and Westmoreland. MAWC's historical service area expansion and distribution system development have been greatly influenced by the demands of local topography. In order to maintain minimum pressure requirements in its extremely hilly service area, MAWC developed as a collection of numerous individual service districts. MAWC's service area has grown

incrementally from serving only two Westmoreland County communities into a system of 48 separate but interconnected service districts. Raw water is also provided to a single industrial customer, Allegheny Ludlum, and a neighboring water authority.

2.1.1 Population Trends

The total population estimated for the service area in the year 2000 is 366,000. Since 1970, population growth has been modest in the service area, with some municipalities experiencing population declines. Population growth forecasted by PADEP is also modest. The study area population is projected to grow by 22% (80,500) between 2000 and 2040 to a total population of 447,000 (see Table 2.1). MAWC projects their number of customers to increase from its current total of 111,000 to 142,000 by the year 2040, an overall increase of 28%.

Table 2.1 MAWC Service Area Population

Year	Total Population	Ten Year Percentage Increase	Annual Percentage Increase
1970	361,068	-	-
1980	376,002	4.1%	0.41%
1990	354,876	-5.6%	-0.58%
2000	366,369	3.2%	0.32%
2010	388,957	6.2%	0.60%
2020	407,285	4.7%	0.46%
2030	426,230	4.7%	0.45%
2040	446,795	4.8%	0.47%
Source: PADEP			

2.1.2 MAWC System Description

The MAWC owns and operates three water treatment plants. Each water treatment plant has associated raw water supply sources. The effective capacity of each treatment plant is determined by the plant's physical infrastructure and allocated raw water supply. All potable water distributed by MAWC is treated by one of these plants with the exception of small volumes of water purchased from neighboring authorities that are distributed to areas that are either remote from the principal system or located at too high an elevation to be served by the principal system. General characteristics of each plant are provided below in Table 2.2.

Table 2.2 MAWC Filtration Plant General Characteristics

Filtration Plant	Filtration Capacity	Delivery Capacity	Transmission Capacity
Indian Creek	78 MGD	76 MGD	80 MGD
George R. Sweeney	30 MGD	36 MGD	42 MGD
McKeesport	10 MGD	10 MGD	9 MGD

The Indian Creek Filtration plant has a rated filtration capacity of 78 MGD, a delivery capacity (using all pumps) of 76 MGD, and a transmission capacity of more than 80 MGD. However, the effective capacity of this plant is greatly reduced by limited supply sources. The

Indian Creek Plant is supplied by the Youghiogheny River and the Indian Creek Reservoir. The Indian Creek Reservoir is a small 251 million gallon impoundment reservoir that supplies 5 MGD to the Indian Creek Plant. The Youghiogheny River, downstream of the Youghiogheny Lake Reservoir, is the main source of supply for the Indian Creek Plant. MAWC is currently permitted (PADEP) to withdraw as much as 50 MGD from the Youghiogheny River. The PADEP permit requires MAWC to find additional supply sources when withdrawal from the Youghiogheny River and the Indian Creek reservoir exceed 28 MGD averaged in a 30-day period. Withdrawal in excess of 28 MGD indicates that withdrawal from the Youghiogheny River is in excess of 23 MGD. The MAWC first exceeded the 23 MGD limit in 1991.

Table 2.3 shows effluent data for the Indian Creek Plant from 1991 to 2000. Data presented in the table include the annual single day maximum delivery volume, the annual average daily delivery volume, and the annual number of times delivery exceeded 28 MGD averaged in a 30-day period. The data includes 5 MGD supplied by the Indian Creek Reservoir. The remaining supply is withdrawn from the Youghiogheny River.

Table 2.3 Indian Creek Filtration Plant Effluent 1991 – 2000
(Thousands gallons per day)

Year	Maximum Day	Average Day	30 Day Avg. > 28 MGD
1991	30,500	23,300	2
1992	27,500	24,200	0
1993	28,000	23,000	4
1994	30,800	22,400	15
1995	28,500	22,900	2
1996	28,000	21,100	1
1997	27,900	20,700	0
1998	28,000	20,900	1
1999	30,000	23,300	19
2000	27,600	22,000	0

Source: MAWC

The George R. Sweeney Filtration Plant has a rated filtration capacity of 30 MGD, a delivery capacity of 36 MGD, and transmission capacity of 42 MGD. The single source of supply for this plant is the 11 billion gallon Beaver Run Reservoir. The total allocation available from Beaver Run Reservoir is 35 MGD which includes raw water supplied to Allegheny Ludlum. Currently, Allegheny Ludlum consumes approximately 5 MGD, leaving 30 MGD available to supply the George R. Sweeney Filtration Plant. Available allocations to the plant have been reduced to as low as 24 MGD in the early 1990's when Allegheny Ludlum had increased raw water consumption.

The McKeesport Filtration Plant has a rated filtration capacity of 10 MGD, a delivery capacity of 10 MGD, and transmission capacity of 9 MGD. The single source of supply for this plant is the Youghiogheny River. Total supply from this source is 10 MGD.

2.2 Current and Projected Raw Water Supply

Raw water supplies to MAWC's three filtration plants are shown in Table 2.4. Allocations from the Youghiogheny River are withdrawn from two locations. The Indian River Filtration plant draws from the river in the vicinity of Connellsville. The McKeesport Filtration Plant draws from the river at McKeesport. MAWC does not draw raw water directly from the Youghiogheny River Lake.

Table 2.4: MAWC Raw Water Supply Under Normal Conditions (MGD)

Plant	Supply Allocation	Processing Capacity
Indian Creek Plant	28	76
George R. Sweeney Plant	35	30
McKeesport Plant	10	9
Totals	73	115
Source: MAWC 1999 Long Range Plan		

Current raw water supply to MAWC under normal conditions totals 73 MGD. However, not all of this water is available for distribution as potable water to the service districts. Allegheny Ludlum currently draws approximately 5 MGD of raw water out of the system, leaving 68 MGD for potable water distribution.

Expansion of supply sources is limited by the capacities of the system, such that increasing supply to the Indian Creek Plant is the only viable expansion option given existing conditions. The McKeesport Filtration Plant has a current effective capacity of 9 MGD, with the limiting factor being transmission limitations. Proposed upgrades will increase the plant's effective capacity to 10 MGD, which is equivalent to the plant's existing raw water supply. The George R. Sweeney Filtration plant has a current effective capacity of 24 MGD with the limiting factor being the plant's rated filtration capacity. Proposed upgrades will increase the plant's effective capacity to 56 MGD. Raw water supplied to the Sweeney Plant comes from the Beaver Run Reservoir, which can sustain total raw water supplies at 35 MGD under normal conditions. Since 5 MGD is assumed to be the average requirement for Allegheny Ludlum, the total supply available to the Sweeney plant is 30 MGD, which is 54% of the plant's anticipated effective capacity. However, under emergency conditions Beaver Run Reservoir can supply the full 56 MGD. The purpose of building excess capacity into the system at the Sweeney Plant is to create enough short term emergency capacity to maintain delivery throughout the system with the largest plant, the Indian Creek Filtration Plant, out of service.

The Indian Creek Filtration Plant has a current and anticipated processing capacity of 76 MGD. However, the plant's current effective capacity is 28 MGD. The limiting factor is the plant's raw water supply, which is 28 MGD under normal conditions. Current excess capacity at the plant is 48 MGD. The Indian Creek Filtration Plant is the only plant in the system that has an existing raw water source, the Youghiogheny River, capable of supplying additional raw water under normal conditions and has the excess capacity to process additional raw water supplies.

2.3 Potable Water Demand

Potable water demand projections were estimated by MAWC as a part of their 1999 Long Range Plan. The objective of this plan is to assess MAWC's current and future ability to satisfy potable water demand in their service area and to identify basic capital improvement requirements. Potable water demand projections are a single component of a larger analysis that provides specific recommendations concerning system configuration, infrastructure, and equipment upgrades aimed at meeting projected demand. Development of the Long Range Plan included the creation of a computer model of MAWC's entire distribution system, capable of identifying the hydraulic capacity of principal components throughout the system. The Long Range Plan also identified increased water supply allocation to the Indian Creek Filtration Plant as a major capital improvement requirement.

2.3.1 Historical and Current Demand

Baseline data for demand projections are based on average delivery and consumption data for calendar years 1996 and 1997, the two most current years of available data at the time of the analysis. Data from 1988 (the most severe hot and dry summer in recent years) and 1994 (with the highest recorded delivery day in MAWC's history) are also included to provide peak day demand data. Average day delivery increased by 6.6% from 1988 to 1997. Population in MAWC's service area increased by only 3.2% during the comparable period 1990 to 2000. Table 2.5 shows potable water delivery data that was originally presented in the 1999 Long Range Plan.

Table 2.5: MAWC Potable Water Demand

Year	Peak Day (MGD)	Avg Day (MGD)	Peak Day/Avg Day
1988	57.1	45.3	126.1%
1994	59.6	45.4	130.9%
1996	56.1	48.3	116.1%
1997	58.1	48.3	120.2%
96/97 avg	57.1	48.3	118.1%

Source: MAWC 1999 Long Range Plan

2.3.2 Non-Revenue Use Demand

A significant component of total potable water demand is water delivered into the system that is not sold through meters. This non-revenue producing water may be water used for treatment plant and line flushing, and water lost through known and unknown leaks. The 1996/1997 average daily non-revenue use demand was 21 MGD, the equivalent of 43.5% of total average daily delivery. Non-revenue use demand at individual service districts range from 13% to 79% of district average daily delivery.

Non-revenue use demand is considered a constant demand upon the system that is not dependent on time of day or time of year. Unlike consumer demand, non-revenue use demand is directly impacted by MAWC actions. The Authority is currently engaged in an aggressive leak detection and pipeline replacement program.

Projected quantities of non-revenue use demand are based on the assumption that districts that currently have the highest level of non-revenue use will continue to be the focus of leak detection and pipeline replacement efforts. Districts with current non-revenue use demand in excess of 30% of average daily delivery are projected to reduce non-revenue use demand by 50% in 2040. Increased sales, including new water line extensions and increased delivery through existing lines, are projected to have an associated 18% non-revenue use demand.

2.3.3 Potable Water Demand Projections – 2040

Potable water demand projections are based on a combination of PADEP population projections for each municipality served by MAWC and historical customer data, including individual customer demand and identification of customer type. Extensive mapping of each MAWC service district was used to determine the land area portion of each municipality served and to identify the potential for service growth in each district. Non-revenue use demand was forecasted according to assumptions identified in the previous section. Table 2.6 shows the 1996/1997 average and projected 2040 average day demand for residential, non-residential, and non-revenue components of total demand.

Table 2.6 MAWC Average Day Demand Projections (MGD)

	Residential	Non-Residential	Non-Revenue	Resale	Total
1996/1997 avg	15.2	9.3	21.1	2.7	48.3
2040	20.0	11.8	16.9	4.2	52.9
Total % change	31.5%	26.9%	-19.9%	55.6%	9.5%
Annual % Change	0.65%	0.57%	-0.53%	1.05%	0.22%

Source: MAWC 1999 Long Range Plan

Potable water demand projections also incorporate maximum peak day demand and normal peak day demand projections[1]. Projected maximum and peak day demands are based on ratios of peak day sales (total delivery less average daily non-revenue use) to projected average day sales. Normal peak day demand is calculated as 136% of average daily sales plus total non-revenue use. Maximum peak day demand is calculated as 155% of average daily sales plus total non-revenue use. Table 2.7 shows projected 2040 average and peak day demands.

Table 2.7: Projected MAWC 2040 Average and Peak Day Demands (MGD)

Average Daily	Normal Peak Day	Maximum Peak Day
52.9	65.9	72.7

Source: MAWC 1999 Long Range Plan

[1] Maximum peak day demand is the highest single day delivery requirement for the system. This demand parameter defines design capacities of processing facilities within the system. Normal peak day demand is the maximum daily demand that is expected to be encountered on a regular basis. Normal peak day demand is used as the design parameter for system redundancy and transmission capabilities.

2.4 Supply Deficit

Demand projections alone are not sufficient information for the identification of MAWC's future raw water supply needs. The configuration of MAWC's supply, processing, and delivery systems provides an opportunity to establish an additional measure of security into the system by planning and designing for system redundancy. MAWC's goal of system redundancy includes the ability to supply service to every customer in the system in the event of an extended loss of any filtration plant in the system. Redundancy is the long term objective of the capital improvements identified by the 1999 Long Range Plan. Under existing supply conditions and with all anticipated system upgrades in place, the limiting redundancy scenario is the extended loss of the Sweeney Filtration Plant. Under this scenario the McKeesport Plant (10 MGD) and the Indian Creek Plant (28 MGD) would be capable of supplying 38 MGD, given existing supplies. The projected average daily demand for 2040 is 53 MGD and the normal peak day demand is 66 MGD, indicating existing supply allocations are 15 MGD short of meeting redundancy requirements for average delivery and 28 MGD short for normal peak day delivery.

The Indian Creek facility, as stated previously, is the only filtration plant in the system with a potential source of additional supply and the capacity to process additional supplies. Increasing supply allocations to the Indian Creek Filtration Plant would support MAWC's redundancy goals.

The total existing raw water supply allocation to MAWC of 73 MGD is within the capacity constraints of the system (see Table 2.4 above). Projected 2040 average daily demand (53 MGD) and normal peak day demand (66 MGD) fall within anticipated supply and capacity constraints. Projected 2040 maximum peak day demand (73 MGD) is 5 MGD greater than system constraints. Given existing supply allocations, anticipated system upgrades, and projected demand, MAWC will not meet the future potable water needs of the community it serves, without additional supply allocations.

In addition, exiting supply allocations do not meet MAWC's redundancy requirements. MAWC is currently engaged in a long term capital program aimed at achieving system redundancy in the future. MAWC's redundancy goal would be greatly supported by an additional allocation of raw water supply from the Youghiogheny River to the Indian Creek Plant. Under the scenario of the extended loss of the Sweeney Filtration Plant, the McKeesport Plant (10 MGD) and the Indian Creek Plant (28 MGD) would be capable of supplying 38 MGD. An additional allocation of 15 MGD to the Indian Creek Plant would be required to achieve the 53 MGD projected average daily demand for 2040 (38 MGD + 15 MGD = 53 MGD), thereby supporting MAWC redundancy objectives.

3 PRELIMINARY COST OF STORAGE AND FINANCIAL FEASIBILITY ANALYSIS

Existing authorized purposes of the Youghiogheny River Dam Project include flood control, low flow augmentation for water quality control, fish and wildlife, general recreation, white water

recreation, and hydropower. Of these project purposes, all available storage is allocated to flood control and low flow augmentation

The alternative that is the focus of this analysis specifies the reallocation of storage (10,000 acre-feet) to water supply in order to provide 17 MGD to MAWC. Under this alternative, MAWC would withdraw water from the Youghiogheny River approximately 29 river miles downstream of the dam at Connellsville, PA. Currently, uncontrolled flow at Connellsville is augmented by releases from Youghiogheny Lake according to the existing storage and release schedule. Under this alternative, the Lake's release schedule would be modified to augment uncontrolled flow in order to provide 17 million gallons per day for water supply purposes (appx. 25 cfs), during those days that additional augmentation is required. This water would be released into the reach of the Youghiogheny River extending from the Lake discharge to the MAWC withdrawal point in South Connellsville. Existing project purposes, including low flow augmentation for water quality and white water recreation would be maintained.

The cost to the non-Federal sponsor for the capital investment of reallocated storage is calculated as the maximum of:

- benefits foregone by the reallocation;
- revenues foregone by the reallocation;
- replacement cost of the reallocated storage; or
- the updated cost of storage in the Federal project.

The non-Federal sponsor is also responsible for any construction and operational costs associated with the reallocation including costs of revising the project's water control plan and environmental mitigation costs.

The test of financial feasibility that compares the annual cost of storage to the non-Federal sponsor to the annual cost of the non-Federal sponsors most likely, least costly water supply alternative.

3.1 Benefits Foregone

The Youghiogheny Lake currently provides the following categories of downstream benefits: flood control, water quality control, fish and wildlife support, general recreation, white water recreation, and hydropower. Benefits provided by the pool include general recreation and fish and wildlife support. Benefits would be foregone if the proposed reallocation and modified release schedule were expected to reduce the generation of benefits in any benefit category. Reallocation of 10,000 acre-feet of storage to water supply and modification of the release schedule to augment uncontrolled flow are not anticipated to negatively impact any of the benefits currently generated by the project (see Economic Impacts section below).

3.1.1 Flood Control & Low Flow Augmentation

The proposed reallocated storage accounts for approximately 4% of the Lake's storage capacity (242,090 acre-feet). The proposed reallocation and modified release schedule will not change the overall magnitude of the draw down within the Youghiogheny River Lake as it is required

for flood protection. The proposed action will cause slightly more water to be held in the Lake during spring and early summer so that water conserved during the wet time of the year can be released during the driest portion of the water year (mid and late Summer months).

The proposed reallocation would, however, reduce low flow storage by 10,000 acre-feet. The possibility of reallocating 10,000 acre-feet from low flow augmentation to water supply is due to historic and continuing water quality improvements downstream of the dam that have reduced the release volume needed to maintain downstream water quality.

3.1.2 Hydropower

A 12 MW hydropower generator operates at the outflow of the dam. Higher pool elevations in the lake during the late summer and early fall will increase the hydraulic head at the hydropower facility which allows the facility to generate more electricity. The economic benefits of increased electric production during this time of year, however, are offset by lower flow rates through the hydropower facility that would occur during water conservation periods. Discussions with personnel at D/R Hydro, the company that operates the hydropower facility, indicate that there is no economic impact associated with increased pool elevations due to the offsetting effects of increased hydraulic head and decreased flow.

Dissolved oxygen levels at the hydropower intake will be lowered due to the longer duration of higher pool elevations. However, the minimal cost this imposes on the hydropower facility are offset by the benefits of slightly increased hydraulic head. Overall, there is no net effect on hydropower related benefits.

3.1.3 Whitewater Recreation

Current dam operations take advantage of opportunities to enhance downstream whitewater rafting by coordinating release schedule changes with heavy weekend use of the river. These minor nuances in the release schedule are typically conducted by slightly lowering the volume of water released during the week and then compensating with greater releases during the weekend. However, these slight adjustments are not guaranteed and can only be accomplished under limited favorable conditions. These opportunistic releases will continue under the existing and proposed release schedules. Therefore, there is no expectation of reduced whitewater recreation benefits.

3.1.4 General Recreation

Water quantity and water quality modeling were undertaken in the feasibility analysis to quantify the impacts of proposed reallocation and modification to the release schedule. The critical downstream water quality parameters identified in the feasibility analysis were water temperature and dissolved oxygen levels in the Youghiogheny River from the dam to McKeesport, PA. The preliminary findings of the feasibility level modeling analysis of the reservoir and the river indicate that there is no discernable difference in the projected ranges of water temperature and dissolved oxygen levels between the existing storage allocation and release schedule and the proposed reallocation and modified release schedule. Therefore, the proposed reallocation and modified release schedule are not expected to adversely impact water quality benefits provided by the project. General recreation and fish and wildlife related benefits also are not expected to be adversely impacted by the proposed reallocation and modified release

schedule because of the slight change in release and the associated projected minimal impacts on water quality.

Since the late spring and early summer pool will be held slightly higher with a slower draw down than is currently implemented, there will be some positive general recreation and fish and wildlife benefits from implementing the proposed action. These potential benefits include increased fish productivity in the lake and a longer boating season due to extended dock access. Benefits related to the extended boating season are presented in the Economic Impacts section.

3.2 Revenues Foregone

Revenues foregone are defined as the reduction in revenues accruing to the U.S. Treasury based upon any existing payment agreements related to the project. Revenues foregone to hydropower would be based upon the projected reduction in hydropower output due to the reallocation or modified release schedule. Since there are no payment agreements to the U.S. Treasury related to this project and there is no projected reduction in hydropower output due to the reallocation and modified release schedule, there are no revenues foregone associated with the proposed reallocation and modified release schedule.

3.3 Replacement Costs

Total replacement costs are the costs of providing project benefits that are lost or diminished due to the proposed reallocation. Flood control replacement costs are the costs of providing equivalent flood control protection if reallocated storage is being taken from the flood control pool. Low flow augmentation costs are calculated as the cost of providing an alternative source of flow augmentation. Hydropower replacement costs are calculated as the benefits foregone to hydropower if reallocated storage is being taken from the hydropower pool or as the lowest cost of obtaining power from alternative sources in order to fulfill existing contractual commitments. In this analysis, there is no change in the volume of flood control storage, there is no hydropower pool identified for this project and no net reduction in the hydropower plant's generating capability, and no reduction in low flow benefits due to improved water quality in the receiving waters. Therefore, there are no replacement costs to be estimated for this study.

3.4 Updated Cost of Storage

This method of calculating the cost of capital investment in reallocated storage space is based on the estimated cost of building the existing storage project today[2]. The portion of the updated cost of storage allocated to the non-Federal sponsor is calculated as the proportion of existing usable storage to be reallocated. Usable storage is defined as the amount of storage remaining after 100 years of dam operation.

[2] Construction costs unrelated to storage such as construction costs of recreational facilities are not to be included in construction costs used to calculate the updated cost of storage.

The 1998 Report on Sedimentation of Youghiogheny River Lake was used to estimate usable storage. That report calculated the Full Pool at the Lake to contain 254,811 acre-feet and sedimentation through 1998 to account for 4,208 acre-feet. Extrapolation to one hundred years would increase 1998 sedimentation levels by an additional 3,471 acre-feet. The same study identified the Minimum Pool at 5,040 acre-feet. Table 3.1 shows the calculations used to determine usable storage. The portion of usable storage required by the proposed reallocation is approximately 4% (10,000 / 242,092 = 0.0413).

Table 3.1. Usable Storage Calculations (ac. ft.)

Full Pool	254,811
- sedimentation up to 1998	4,208
Total Storage	250,603
- Minimum Pool	5,040
Actual Storage	245,563
- extrapolated sedimentation	3,471
Usable Storage	242,092

Construction costs were updated in four categories using the Engineering News Record (ENR) construction cost index and the Corps of Engineers Civil Works Construction Cost Index System (CWCCIS) as identified in EM 1110-2-1304. The four cost categories include dams and appurtenances, buildings and grounds, relocations, and land. The value of lands is updated by the weighted average update of all other project features, as per the Water Supply Handbook, revised IWR Report 96-PS-4, December 1998. Since the CWCCIS dates back only to 1967, the ENR construction cost index was used to update project costs to 1967.

The period of expenditure for each project feature is 1939 – 1951 (mid-point 1945) as identified in the 1992 Youghiogheny River Lake Summary of Pertinent Data dated 20 September 1992. Table 3.2 shows the cost update calculations from the mid-point of expenditures (1945) to 1967, using the ENR construction cost index. Table 3.3 shows the cost update calculations from 1967 to Fiscal Year 2002 using the CWCCIS, revised 31 March 2001.

Table 3.2 Updated Cost of Construction 1945 – 1967 ($ thousands)

Cost Category	Original Cost	ENR index 1945	ENR Index 1967	Update Factor	1967 Cost
Dams & Appurtenances	$4,970	308	1074	3.487	$17,330
Buildings & Grounds	$1,113	308	1074	3.487	$3,881
Relocations	$2,086	308	1074	3.487	$7,274
Land Acquisition	$831	N/A	N/A	N/A	N/A
Totals	$9,000				N/A

Table 3.3 Updated Cost of Construction 1967 – FY 2002 ($ thousands)

Cost Category	1967 Cost	1967 CWCCIS	FY 2002 CWCCIS	FY 2002 Cost
Dams & Appurtenances	$17,330	100	527.87	$91,482
Buildings & Grounds	$3,881	100	496.53	$19,271
Relocations	$7,274	100	538.98	$39,205
Land Acquisition	N/A	N/A	18.36*	$15,255
Totals	N/A			$165,213

* * Derivation of Lands & Damages Update Factor:
As-built Joint-Use Cost (-) Lands and Damages = $8,169.
FY '02 Cost (-) Lands and Damages = $149,958.
Ratio 149958 / 8169= 18.36

The updated FY 2002 total cost of construction is $165,213,000 (excluding interest during construction) and the non-Federal sponsor's proposed proportion of usable storage is 0.0413. The updated cost of storage allocated to the non-Federal sponsor is $6,823,300 ($165,213,000 * .0413 = $6,823,300).

The updated cost of storage will be used as the cost to the non-Federal sponsor for the capital investment of reallocated storage, as it is the highest cost out of the four cost calculation methods. The non-Federal sponsor is also responsible for a proportional share of operation and maintenance costs, the cost of updating the project's water management plan, and any costs specific to the reallocation such as environmental mitigation costs.

3.5 Test of Financial Feasibility

The test of financial feasibility compares the non-Federal sponsor's cost for the capital investment of reallocated storage at the project (identified above) to the cost of the most likely, least costly alternative that would be taken by the non-Federal sponsor to meet projected water supply needs. Costs are annualized over a 50-year planning horizon using the current Federal discount rate of 5.875%.

MAWC has indicated that the most likely least cost alternative to reallocating storage at Youghiogheny Lake is the construction of a new impoundment at Indian Creek. The new impoundment would consist of a 226-foot tall dam located at the mouth of Indian Creek just downstream of the far smaller existing dam. Although the purpose of the dam is to provide 17 MGD of water supply to MAWC, the dam must be designed to meet numerous criteria including maintenance of low flow in Indian Creek and drought contingencies. Total storage volume would range from 6,827 million gallons at pool elevation 1140 feet to 23,000 million gallons at pool elevation 1245 feet. The estimated 1976 cost of construction was $25,220,610. This cost is updated to FY 2002 by comparing the CWCCIS index for reservoirs in FY 1977 (226.15) to the

index in FY 2002 (588.79). The resulting adjustment factor is 2.604 (588.79/226.15 = 2.604) and the updated FY 2002 cost of construction for the Indian Creek impoundment is $65,662,800.

FY 2002 operation and maintenance costs for Youghiogheny Lake were estimated to be $600,000. The proportion allocated to the non-Federal sponsor is $24,780 ($600,000*.0413 = $24,780). Operation and maintenance costs for the Indian Creek impoundment were assumed to be one-half of the operation and maintenance costs for Youghiogheny Lake, or $300,000. Other costs, if required, would be included in the annualized costs allocated to the non-Federal sponsor, such as costs relating to environmental mitigation, additional construction that may be required for the reallocation, and the cost of updating the project management plan. Table 3.4 shows the annualized costs of reallocating storage at Youghiogheny Lake and the annualized costs of constructing a new impoundment at Indian Creek. The comparison of annualized costs indicates that reallocation of storage in Youghiogheny Lake is a less costly alternative for the non-Federal sponsor.

Table 3.4 Annualized Cost Comparison

	Reallocation of Storage	Construction of Impoundment
Total Construction Cost	$6,823,300	$65,662,803
Annualized Construction	$475,978	$4,064,518
Operation & Maintenance	$24,780	$300,000
Total Annual Cost	$500,758	$4,364,518

4 ECONOMIC ANALYSIS OF ALTERNATIVE PLANS

This section analysis identifies and quantifies, where applicable, the economic impacts of the three final alternative plans identified in the Youghiogheny Lake Water Management and Reallocation Feasibility Study

4.1 Description of Alternatives

Each of the final alternative plans provides 17 million gallons per day (mgd) of additional water supply to MAWC without impacting the flood control capabilities of the Youghiogheny River Lake Dam. The alternative plans assessed in this analysis are

- the no action Alternative;
- Release Schedule Alternative 5;
- Release Schedule Alternative 6.

4.1.1 No Action Alternative

The no action alternative is the most likely set of conditions that would exist if the Corps took no action, i.e., no reallocation of storage and no change to the existing release schedule. In accordance with their existing PADEP permit, MAWC is be required to develop an alternative water supply. The most likely alternative water supply has been identified by MAWC as an impoundment of Indian Creek that would be constructed at an estimated cost of $66 million (Fiscal Year 2002, CWCCIS, revised 31March01). This alternative water supply would be used

to supplement withdrawals from the Youghiogheny River. Under the no action alternative it is assumed that MAWC would construct the impoundment at Indian Creek. Although Indian Creek is a tributary to the Youghiogheny River, it is assumed that permit stipulations for the construction and operation of the impoundment would not affect existing conditions at Youghiogheny River Lake or downstream along the Youghiogheny River. Under the no action alternative, MAWC would continue to withdraw an average daily flow of approximately 23 MGD from the Youghiogheny River at Connellsville

4.1.2 Release Schedule Alternative 5

Under Release Schedule Alternative 5, water supply would be added as a project purpose, 10,000 acre feet of storage (4.13% of usable storage) would be reallocated from low flow augmentation to water supply, and the release schedule would be adjusted to minimize impacts on other project purposes. The dam's flood control capabilities would not be changed. MAWC would withdraw its water supply allocation from the Youghiogheny River at Connellsville.

4.1.3 Release Schedule Alternative 6

Under Release Schedule Alternative 6, water supply would be added as a project purpose, 10,000 acre feet of storage (4.13% of usable storage) would be reallocated from low flow augmentation to water supply, and the release schedule would be adjusted to better support lake recreation by maintaining a slightly higher pool in the end of summer and early fall months (see Critical Factors section below for a full presentation of proposed pool elevations). The dam's flood control capabilities would not be changed. As with Release Schedule Alternative 5, MAWC would withdraw its water supply allocation from the Youghiogheny River at Connellsville.

Table 4.1 provides a review of the final alternatives. The proposed storage reallocation would reduce low flow augmentation storage by 10,000 acre feet, which is the equivalent of 6.7% of summer low flow storage and 10.2% of winter low flow storage.

Table 4.1 Review of Final Alternatives

	No Action	Release Schedule Alt. 5	Release Schedule Alt. 6
Project Purpose	No Change	Water Supply Added	Water Supply Added
Storage Reallocation	None	10,000 ac.ft. to water supply from low flow	10,000 ac.ft. to water supply from low flow
Flood Control Storage	No Change	No Change	No Change
Water Supply Storage	No Change (none)	10,000 acre feet	10,000 acre feet
Low Flow Storage	No Change (Summer 149,300 ac.ft.) (Winter 97,800 ac.ft.)	10,000 ac.ft. reduction (Summer 139,300 ac.ft.) (Winter 87,800 ac.ft.)	10,000 ac.ft. reduction (Summer 139,300 ac.ft.) (Winter 87,800 ac.ft.)
Release Schedule	No Change	Adjusted to minimize impacts	Adjusted to enhance lake recreation
Withdrawal Location	No Change (Connellsville)	No Change (Connellsville)	No Change (Connellsville)
Additional Structures	Impoundment at Indian Creek	None	None

4.2 Economic Impacts of Alternatives

The Youghiogheny River Lake Project provides economic value and supports economic behavior, such as recreation, real estate development, and economic development in a number of ways that are based on services provided by the dam and the impounded water. Services provided by the dam and impounded water include project purposes such as, flood control, water quality maintenance, recreation, and fish and wildlife habitat. Services may also be other than project purposes, such as hydropower production and water supply. If the implementation of an alternative plan were to change the type or level of service provided by the dam and/or impounded water in any way, such as increasing the volume of water available for hydropower production or decreasing the quality of fish habitat, there would be an associated change in economic value or behavior that would be considered an economic impact. Typically, the greater the magnitude of the change in service provided the larger the economic impact. Very small changes in services provided would result in very small economic impacts.

4.2.1 No Action Alternative

The no action alternative does not change the dam's existing release schedule, MAWC would continue to withdraw water from the Youghiogheny River at Connellsville at levels that are consistent with existing withdrawals, and it is assumed that construction and operation of the impoundment at Indian Creek will not affect existing services provided by the Youghiogheny River. Therefore, there the no action alternative plan imposes no changes on services currently provided by the dam and impounded water.

Full design and operational planning for the Indian Creek impoundment have not been completed, though construction and operation of the impoundment would generate economic impacts for the local economy in terms of increased employment, wages, and revenues. However, these construction related impacts would be short term and it is anticipated that much of the services and materials required to build the impoundment would come from outside the local region. A quantitative estimate of construction related economic impacts cannot be performed until more planning and construction information is available.

Recreational opportunities at the Indian Creek impoundment are based on the assumption that boating, fishing, and swimming access would be available. Recreation related economic impacts of the proposed impoundment, would include both RED and NED benefits which can be estimated once a recreation plan for the impoundment is developed.

4.2.2 Release Schedule Alternative 5

Release Schedule Alternative 5 was designed to minimize impacts to existing project purposes while providing an additional 17 mgd to the withdrawal location at South Connellsville. Reservoir and riverine modeling projections indicate that water quantity and water quality effects in the lake and in the river would be negligible. The negligible affect on critical factors relating to services provided by the dam and impounded water would cause no measurable changes to those services and therefore would cause no measurable economic impacts. Minor economic impacts to hydropower production are presented in Table 4.6.

4.2.3 Release Schedule Alternative 6

Release Schedule Alternative 6 also was designed to provide an additional 17 mgd for water supply, and to improve recreational opportunities at the lake by increasing pool elevations in the late summer and early fall. Increasing pool elevations at that time of year would significantly extend the boating season on the lake, which has been a long standing request by the local boating and business community. The potential economic impacts of an extended lake boating season are discussed below.

4.2.3.1 Lake Boating

Release Schedule Alternative 6 produces higher pool elevations in the late summer and early fall months. The timing of these higher pool elevations would extend the Youghiogheny Lake boating season by providing water to boat ramps, marina docks, and private docks that are currently unusable (dry) during portions of the main boating season (May – October). Table 4.2 presents critical pool elevations for Youghiogheny Lake boating facilities and the estimated additional amount of time each facility would be usable in an average weather year under Release Schedule Alternative 6.

The main boating season extension estimates shown in Table 4.2 are based on the assumption that, in general, weather conditions bring the main boating season to a close at the beginning of November. The boating use estimates presented below are also based on the assumption that boating during the winter and spring boating season would not be affected by Release Schedule Alternative 6. The boat ramp at Tub Run would not be affected since the annual closing of this facility is coordinated with the closing of the adjacent camp ground, typically soon after Labor Day.

Table 4.2 Release Schedule Alternative 6 Lake Boating Season Extensions

Facility	Minimum Usable Pool Elevation	Existing End of Facility Availability	Proposed End of Facility Availability	Facility Availability Extension
Spillway	1391	November	November	No Change
Somerfield N.	1397	End October	November	1 week
Somerfield S.*	1399	Mid October	November	2 weeks
Jockey Hollow	1420	Mid September	Early October	3 weeks
Mill Run	1430	Mid August	End August	2 weeks
Private Docks	1415	End September	Mid October	3 weeks
*Marina				
Source: Pittsburgh District, Operations and Readiness Division				

The additional availability of boating facilities is dependent upon pool elevations that will change from year to year due to annual rainfall and runoff conditions. The projections presented in Table 4.2 are based on average year pool elevations. Boating facility availability would be expected to be greater than the projections presented above during wet years and less than the projections during dry years. Variations in pool elevations, due to annual variations in rainfall and runoff, cause fluctuations in boating use of the lake from year to year. Boat use of the lake can also be impacted by maintenance operations at the dam, such as the Spillway Ramp reconstruction in FY 2000. Table 4.3 shows estimated annual total recreation visitation to the lake and estimated annual boating use.

Table 4.3 Youghiogheny Lake Total Recreation and Boat Use (Visits)

	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
Total Visits	568,965	560,111	605,849	683,906	575,166
Boat Use	85,000*	78,416	96,943	101,333	85,926*
*Estimates based on average percentage of boat use					
Source: Pittsburgh District, Operations and Readiness Division					

The projected changes in boat use at the lake that would result from alternative release schedule 6 are shown in Table 4.4. These projections are based on average weekly use of each facility (FY 1997 – FY 1999) during the late summer and early fall, as calculated from monthly facility use estimates provided by the Pittsburgh District, Operations and Readiness Division. The projected number of additional trips for each facility is the product of estimated average weekly use and the projected number of additional weeks the facility would be available under this alternative plan. For private docks, it was assumed that there is one visit per dock each week.

Table 4.4 Release Schedule Alternative 6 Additional Lake Boating Trips

Facility	Additional Availability	Average Number of Weekly Trips	Total Projected Increase in Trips
Somerfield N.	1 week	422	422
Somerfield S.*	2 weeks	1,097	2,197
Jockey Hollow	3 weeks	816	2,448
Mill Run	2 weeks	136	272
Private Docks	3 weeks	625	1,875
Total Projected Annual Increase in Lake Boating Trips			7,214

The economic impacts of increased boating at the lake can be viewed from two perspectives: (1) regional economic impacts that include increases in sales, income, and employment, and (2) national economic development benefits that include the increase in recreational value that boaters receive when they take additional boating trips on the lake. The regional economic impacts estimated for the extension of the boating season are calculated as sales and income effects. Sales effects are the sum of increased expenditures by boaters (direct effects), the related expenditures by businesses required to meet the additional demand for goods and services (indirect effects), and the expenditures of employees whose wages are related to the initial direct expenditures (induced effects). Regional economic impacts can also be measured as income effects that are the related changes in regional incomes due to the direct, indirect, and induced sales effects described above. Employment effects are the increased number of jobs associated with the sales and income effects. The projected boating season extension on the Youghiogheny Lake would not be expected to increase employment in terms of additional jobs, but it would increase labor hours and wages. This increase in wages is captured in the income effects mentioned above.

RED Impacts

Table 4.5 shows the projected regional economic impacts associated with Release Schedule Alternative 6. The direct per trip boater spending at Youghiogheny Lake is calculated from a Pittsburgh District analysis of 1996 day use visitor spending at the lake. The 1996 per trip spending estimate ($17.19) was inflated to March 2001 dollars ($19.32) using the standard Consumer Price Index. Direct, indirect, and induced effects were calculated using the online "Worksheet for Estimating Economic Impacts of Visitor Spending at Corps of Engineers (CE) Projects" described in Technical Report R-98-1 "Estimating the Local Economic Impacts of Recreation at Corps of Engineers Projects – 1996". Calculations used default model settings, recreational boater participation as estimated in the previous section, and the individual spending data found in the Pittsburgh District's 1996 analysis.

Table 4.5 Release Schedule Alternative 6
Projected Regional Economic Impacts

	4.2.3.2 Sales	***4.2.3.3 Income***
Direct Effects	$139,374	$72,475
Indirect Effects	$25,087	$12,544
Induced effects	$66,900	$36,237
Totals	$231,361	$121,256
Note: Based on 7,214 additional boating trips		

NED Impacts

National economic development benefits that would result from Release Schedule Alternative 6 are estimated as the increase in recreational value that boaters receive when they take additional boating trips on the lake. The value of a single boating trip on the Youghiogheny Lake is based on the FY 2001 Unit Day Values for General Recreation as reported in Economic Guidance Memorandum 01-1. The maximum general recreation value ($8.46) is applied to boat trips on the lake based upon the ease of access, outstanding aesthetic quality, high carrying capacity, distance to other similar facilities and excellent boating opportunities available on the lake. National economic development benefits are calculated as the product of the Unit Day Value ($8.46) and the projected number of additional boat trips (7,214). The total national economic development benefit associated with this alternative plan is $61,030 ($8.46 * 7,214 = $61,030).

4.2.4 Hydropower

Increased pool elevations will also affect hydropower generation at the dam. This alternative plan affects hydropower generation by increasing the hydraulic head at the generating plant, changing the flow through the plant, and by decreasing dissolved oxygen levels at the plant intake. The economic impacts related to hydropower generation are discussed below.

Higher pool elevations in the lake during the late summer and early fall will increase the hydraulic head at the hydropower facility which allows the facility to generate more electricity. The economic benefits of increased electric production during this time of year, however, are offset by lower flow rates through the hydropower facility that would occur during water conservation periods. Discussions with personnel at D/R Hydro, the company that operates the hydropower facility, indicate that there is no economic impact associated with increased pool elevations due to the offsetting effects of increased hydraulic head and decreased flow.

Higher pool elevations in the lake during the late summer and early fall also impact hydropower production due to the increased number of days that dissolved oxygen levels are projected to fall below 7 mg/l at the hydropower plant intake. The hydropower facility is required to use low pressure blowers to increase dissolved oxygen levels when dissolved oxygen levels measured at the intake fall below 7 mg/l. D/R Hydro estimates the cost of running the blowers to be $200 per day. The projected economic impacts to hydropower production under Release Schedule Alternatives 5 and 6 is presented in Table 4.6.

Table 4.6 Projected Hydropower Economic Impacts (Annual)

	Days DO < 7 mg/l	Additional Days	Additional Cost
Existing Release Schedule	109	-	-
Release Schedule Alt. 5	114	5	$1,000
Release Schedule Alt. 6	121	12	$2,400

Note: Based on $200 per day blower cost, as per communication with D/R Hydro

Release Schedule Alternative 6 is projected to have only negligible impacts on water quantity and water quality conditions in the river. The changes to water quantity in the river are very small, and although minor increases in flow are conceptually beneficial to whitewater rafting on the river, the changes are too small to have a measurable economic impact. Similarly, water quality conditions, water temperature and dissolved oxygen levels, would be only slightly affected by the alternative plan. The minor effects on water quality are not projected to have measurable impacts on the existing cold water fishery. Given the low level of projected impacts to riverine conditions, there are no measurable economic impacts attributed to changes in riverine conditions associated with Release Schedule Alternative 6.